THE IMPACT OF ARTIFICIAL INTELLIGENCE ON MODERN EDUCATION: PROSPECTS AND CHALLENGES

A. Nykonenko
Cherkasy State Technological University, Ukraine
Shevchenka Blvd, 460, Cherkasy, 18000
andrey.nikonenko@gmail.com
https://orcid.org/0000-0002-9442-1601

Annotation. This paper examines the intricate links between artificial intelligence (AI) and education, delving into both theoretical and practical aspects while evaluating possible ramifications for labor market dynamics, professional activity, and wider educational paradigms. Our research methodology involved analyzing relevant scientific literature, classifying data, consulting with subject matter experts, and synthesizing the results. Our research suggests that AI has the ability to greatly improve pedagogical processes, personalize learning experiences to meet individual student needs, and successfully address the time and financial limitations that are inherent in traditional educational models. However, our study also reveals challenges related to data confidentiality, potential plagiarism and fraud associated with AI use, and socioeconomic disparities resulting from unequal technology access.

Additionally, we identified a significant gap in current AI usage standards legislation. It is essential for researchers, educators, and policymakers to recognize the potential risks of AI implementation in educational settings and proactively develop strategies that prioritize ethics, safety, and effectiveness. With labor market trends favoring specialists knowledgeable in utilizing AI tools, a consequent change in curricula is expected. In response to our findings, we recommend the creation of new academic disciplines that concentrate on the cultivation of AI expertise; the establishment of comprehensive national AI strategies; the crafting of retraining roadmaps for those who may be affected by AI automation; the inclusion of online AI courses in existing educational programs; and the promotion of grant funding for future AI research. Our future research will concentrate on reducing the potential negative impacts of integrating AI into educational systems.

Keywords: artificial intelligence, innovations, educational technologies, future competencies.

ВПЛИВ ШТУЧНОГО ІНТЕЛЕКТУ НА СУЧАСНУ ОСВІТУ: ПЕРСПЕКТИВИ ТА ВИКЛИКИ

А. О. Никоненко
Черкаський державний технологічний університет, Україна
б-р Шевченка, 460, м. Черкаси, 18006
andrey.nikonenko@gmail.com
https://orcid.org/0000-0002-9442-1601

Анотація. Стаття досліджує вплив штучного інтелекту (ШІ) на освіту, аналізує теоретичні та практичні аспекти такого впливу, а також оцінює можливі наслідки для динаміки ринку праці, професійної діяльності та ширших науково-освітніх парадигм. Методологія дослідження включає опрацювання відповідної наукової літератури, класифікацію даних, консультації з експертами і синтез отриманих результатів. Наше дослідження вказує на те, що ШІ має потенціал значно покращити педагогічні процеси, персоналізувати навчання з урахуванням індивідальних потреб студентів, а також успішно вирішити проблеми часових і фінансових обмежень, що є властивими для традиційних освітніх моделей. Однак, дослідження також вказує на виклики, пов'язані з конфіденційністю даних, потенційним плагіатом і шахрайством з використанням ШІ, а також соціально-економічною нерівністю, що може виникнути через нерівний доступ до технологій.

Додатково, ми звертаємо увагу на значні прогалини в поточному законодавстві щодо стандартів використання ШІ. Існує потреба в тому, щоб дослідники, освітяни та законодавці визнали потенційні ризики застосування ШІ в освітньому середовищі та активно включилися в розробку стратегій використання ШІ, спрямованих на етику, безпеку та ефективність. З урахуванням трендів на ринку праці та росту потреби в спеціалістах, які володіють навичками використання інструментів ШІ, потрібна відповідна зміна в навчальних програмах. Проведене дослідження виявило потребу у створенні нових академічних дисциплін, сфокусованих на розвитку компетенцій у галузі ШІ; розробку всеохоплюючої національної стратегії розвитку та впровадження ШІ; створення дорожньої карти для перепідготовки осіб, яких може бути скорочено через автоматизацію з

використанням ШІ; включення онлайн-курсів зі ШІ до існуючих освітніх програм; сприяння отриманню грантового финансування для майбутніх досліджень ШІ.

Ключові слова: штучний інтелект, інновації, освітні технології, компетенції майбутнього.

Introduction

In the modern world of information technologies, artificial intelligence (AI) is increasingly permeating various spheres of human activity, which is especially noticeable in the field of education. Expanding the capabilities of AI provides new perspectives for pedagogical practice and requires adaptation of educational processes to changing conditions. That's why research on the impact of AI on education, identification of possible prospects and challenges in the future is becoming relevant.

Recent studies and publications show a mixed view on the impact of artificial intelligence on education. On the one hand, modern technologies contribute to the rapid acquisition of information; on the other hand, they raise concerns about children's readiness for a wide use of new technologies [1]. This raises questions about possible changes in teaching methods as a result of the use of AI [2]. The need to teach modern students to effectively use digital tools is also noted [2].

One of the key challenges is the authorship of educational materials developed using AI. Legal regulation of copyright is faced with the problem of defining the role of the author [3]. In addition, digitalization is accompanied by new risks and unforeseen consequences [4], in particular with regard to interpersonal communication [5]. At the same time, one cannot ignore the positive side of the use of AI, which is already beneficial today, for example, in medicine for the diagnosis of diseases [6]. On the other hand, the growth of fake news and disinformation due to digital manipulations can be observed [6].

The main purpose of this article is to analyze the theoretical and practical aspects of the application of artificial intelligence in the educational process, as well as to evaluate its impact on the labor market, professional activity and education.

In order to achieve the goal, a comprehensive study was conducted. The main research methods were: analysis of scientific literature, systematization and classification of the obtained data, consultations with experts and synthesis of the obtained results. The use of these methods allows for an in-depth analysis of the impact of artificial intelligence on education and the development of recommendations for its further use in the pedagogical process.

This work aims to reveal the prospects and potential problems of using artificial intelligence in the educational process and to offer appropriate recommendations for its use in pedagogical activities.

Positive consequences of AI application

At the current stage of society's development, the traditional education system is undergoing dramatic changes, one of the leading directions among which is the introduction of information technologies and artificial intelligence should take a significant place among them. General expectations from this process can be described by the following thesis: "modern innovations make people's lives easier" [3], and in education they should lead to increased learning efficiency and the creation of new knowledge. These technologies can contribute to both increasing the level of educational achievement and knowledge assimilation, as well as increasing the convenience of the learning process itself, for example, "thanks to the use of artificial intelligence, teachers will have the opportunity to work more efficiently and save their time" [5].

According to researchers, the changes will affect not only education but also professional activities: "the labor market will need new specialists in mathematics, physics, logic, engineering, medicine, and economics" [4]. It is quite expected that these specialists should receive training that includes the ability

to work effectively with AI. This will also contribute to changes in curricula and revision of the educational process in general.

Great expectations are placed on the implementation of innovations in the organization of the educational process. "Thanks to the digitalization of education, teachers have more time for research, the results of which can be incorporated not only into electronic learning materials, but also into production solutions" [7]. In order to maximize the benefits of innovation, the authors suggest following certain principles: "The digitization of education can be successful if the educational process, which is based on the use of information and communication technologies and is focused on specific users, has specific subject matter, is based on the correct methodology and approaches, interesting content, good student motivation, and a well-established software and hardware base" [8].

The use of AI can also lead to improved learning efficiency. For example, studies show a significant impact of AI-assisted learning on student outcomes: "The program uses technology developed by the Center for Game Science at the University of Washington. It was able to improve the efficiency of learning seventh-grade algebra by an average of 93% in just an hour and a half of use" [9]. Another useful application can be the flexible adaptation of learning to the individual characteristics and needs of students: "The program identifies strengths and weaknesses, gaps in knowledge, and then assigns tasks to correct them." [10].

Individualized education, together with the use of AI in professional activities, contributes to increased efficiency: "the use of machine learning can significantly reduce time and financial costs and contribute to labor productivity" [11]. The positive impact of AI is based on the thesis that "artificial intelligence technologies should contribute to the transformation of the economy, the labor market, government institutions, and society as a whole" [12]. This shows that the importance of AI goes beyond the education sector and affects other areas of public life. General expectations from the introduction of AI technologies can be described by the following quote: "The use of artificial intelligence technologies will help reduce costs, increase production efficiency, and improve the quality of goods and services" [12].

Thus, the main positive effects of the use of artificial intelligence are to facilitate the work of teachers, adapt to the individual needs of students, reduce the time and financial costs of the educational process, and provide additional opportunities for successful transformation and socio-economic development of society.

Negative consequences of AI application

The use of artificial intelligence in education has its benefits, but potential drawbacks must also be considered. For example, there are concerns about the confidentiality of personal data and the undermining of the status of teachers [1]. This could lead to a complete discrediting of new ways of teaching. Serious concerns are being raised about the possible emergence of a personality in artificial intelligence, which could lead to it escaping human control [1]. The risk of job losses falls into the same category: "Working with new technologies and artificial intelligence will leave few areas where humans need to work: medicine, education, personal services, households" [4].

Unregulated access to AI can lead to problems with plagiarism and fraud. For example, ChatGPT has been banned in public schools in New York, Los Angeles, and Seattle due to concerns about these issues [2]. The legal definition and regulation of AI is currently lacking in current legislation [3], making it difficult to develop standards for the use of AI and to draw a line between acceptable and unacceptable use cases. Other common concerns include a shrinking labor market, for reasons such as the automation of routine, repetitive tasks, which could lead to job losses [13]. AI can also take over routine homework, which can lead to a reduction in effort and create the illusion of independent work for students [5]. This, in turn, can lead to a

decrease in student and teacher motivation. Another issue is the objectivity of assessing the results of educational activities by artificial intelligence [5]. For example, biased decisions of systems due to distortion of initial educational data (algorithmic bias) [13, 3] can lead to discrimination against certain groups of students in the assessment.

There are also issues of a more global nature, for example, unequal access to the benefits of artificial intelligence can perpetuate socioeconomic inequalities between different populations and nations around the world [13]. Another global risk is that technological development can also lead to technological dependency [5], which in turn can limit human curiosity and creativity. The question of the impact on social interaction [5] may be related to the possible isolation of students from real communication if all learning is mediated by AI. This can lead to a deterioration of interpersonal skills and empathy. The use of AI may also lead to a violation of privacy [5], as students' personal data may be inappropriately stored and processed. In addition, the proliferation of AI makes it increasingly difficult to ensure the confidentiality and security of information, requiring the constant development of protection mechanisms.

Thus, the negative consequences of the use of artificial intelligence in education can have a serious impact on the quality of the educational process and the social aspects of students' and teachers' lives. It is important that researchers, educators, and lawmakers consider the potential risks and actively develop strategies to ensure the ethical, safe, and effective use of AI in education and society.

Impact on education

The impact of artificial intelligence on modern education can be seen in a number of ways, including the development of technology, the updating of curricula and methods, and the changing roles of teachers and students in the learning process. AI can help create more effective teaching methods and materials, as well as more opportunities to individualize education.

AI can create personalized learning programs that take into account the needs and abilities of each student [5]. This is important because the uniformity of curricula is considered one of the drawbacks of modern higher education [10], and the use of artificial intelligence eliminates this by providing the opportunity to develop and change the curriculum together with students [10]. Chatbots can be an effective tool to improve communication and coordination in an educational institution, as well as to build an educational path [1]. AI can also help improve the quality of materials, for example, ChatGPT can be a mentor or co-author, supporting teachers in their learning and teaching activities and creating interesting and interactive content [2]. Artificial intelligence also provides students with access to more diverse and relevant sources of information [5].

However, without a revision of educational standards and programs, the implementation of AI will remain incomplete [1].

The automation of learning also poses certain risks that need to be managed:

- Widening the gap between rich and poor students due to unequal access to technology [5].

- Lack of direct contact between the teacher and the student (pupil), which can have a negative impact on the quality of education and future professional activity [7].

It is also necessary to take into account the possible technical risks associated with the occurrence of malfunctions of programs and equipment, incorrect storage and archiving of data, etc., as well as the likelihood of increased cyber risks associated with hacker attacks on university servers and software [7]. The quality of AI performance depends on the accuracy of the data provided. If inaccurate information is included in the training data, the results of AI analysis will be incorrect [9]. Therefore, the role of experts to ensure the quality of educational content is important.

Thus, artificial intelligence influences modern education and opens a number of prospects in the development of technologies,

curricula and pedagogical methods. At the same time, ensuring the quality of education and balanced access to new technologies for all stakeholders are important aspects that should be addressed.

Recommendations for AI implementation

In view of the above changes, the implementation of artificial intelligence technologies is an important aspect of the development of education in the modern world. Education can become a way to adapt to the future [1] if it provides high-quality knowledge and skills to work with innovative technologies. At the same time, ensuring the objectivity and fairness of student assessment using AI becomes a particularly important task [5, 3]. The proliferation of AI in education cannot be ignored [5], and the need to improve the digital literacy of teachers and other staff is becoming increasingly apparent [7]. The digitization of education can be successful if it is targeted at specific users, has a specific focus, is based on the right methodology and approaches, interesting content, good student (learner) motivation, and a well-established software and hardware base [7]. At the same time, the insufficient level of quality of higher education and educational programs aimed at training specialists in the field of artificial intelligence in higher education institutions [12] jeopardizes the successful implementation of such innovations.

The Concept of Artificial Intelligence Development in Ukraine was approved by the Decree of the Cabinet of Ministers of Ukraine dated December 2, 2020,[1] 1556-r [3]. However, Ukraine is not yet properly prepared to study artificial intelligence, develop it, and formulate strategies and principles for its implementation [4]. The modern educational system should much better train competitive specialists in the field of artificial intelligence [12]. To ensure this, it is necessary to create new specialties that will be able to train specialists in the field of artificial intelligence [4] and enable them to compete in the international labor market. It is also necessary to create conditions for participation in the activities of international organizations and the implementation of initiatives to formulate strategies for the development, regulation and standardization of artificial intelligence [12].

Another important aspect is the development of a roadmap for retraining people whose work can be automated in the next five to ten years [12]. It is also necessary to integrate leading online courses on artificial intelligence into educational programs, to promote the attraction of grants for scientific activities in the field of artificial intelligence in order to stimulate the transition of Ukrainian scientists to effective models, standards, and forms of cooperation [12, 4]. The use of artificial intelligence technologies in information security is one of the factors that will contribute to the protection of national interests [12]. A society of creators, where artificial intelligence systems will help people to get rid of routine, feel solidarity and spend their free time on creative activities [13], may be a prospect for Ukraine.

Thus, for the successful implementation of AI in education, the following recommendations should be taken into account: creating new specialties for training specialists in the field of artificial intelligence; creating conditions for international cooperation; developing national strategies, principles and standards for the development of AI; developing a roadmap for retraining people; integrating online courses on artificial intelligence into educational programs; and promoting grant funding for research in the field of artificial intelligence.

Conclusions and prospects for further research

This paper examines the impact of artificial intelligence on education, analyzing the main prospects and challenges. The conclusions can be summarized as follows:

- Artificial Intelligence will have a significant impact on the world, but it will take a number of years to determine the exact depth of the changes.

- Many of the risks associated with AI are exaggerated, based on fears of the new technology.

- Job losses due to automation can be offset by the creation of new, highly skilled positions.

- Negative consequences of AI can be avoided through proper regulation and continued research.

- AI has a significant impact on education through automation, curriculum changes, and learning approaches.

The arrival of AI in education highlights the importance of rethinking the skills and knowledge that students acquire. Implementing AI in education today will provide competitive advantage in the future.

References

1. Golovina O. Artificial intelligence: how it will affect education. National University of Eastern Europe. 11.02.2020 URL: https://nus.org.ua/articles/shtuchnyj-intelekt-yak-vin-vplyne-na-osvitu/.

2. Antonio J. The impact of ChatGPT on education. Medium. 22.02.2020 URL: https://medium.com/chatgpt-learning/вплив-chatgpt-на-освіту-d57e62c1686b.

3. Klyan A. How AI is regulated in Ukraine and the world. AIN.UA. 01.02.2022 URL:https://ain.ua/2022/02/01/yak-ai-rehulyuyut-v-ukrayini-ta-sviti/.

4. Stashkevych O. The impact of technology and artificial intelligence on the labor market in Ukraine. InterConf. 2021. - № 81 - C. 25-30.

5. Vyshnyakova O. AI and education: how artificial intelligence will affect school education. LB.ua. 20.03.2023. URL:https://lb.ua/blog/olena_vyshniakova/547626_ai_osvita_yak_shtuchniy_intelekt.html.

6. Savchuk T. 10 examples of how artificial intelligence can change your lifestyle. Radio Liberty. 03.02.2018. URL: https://www.radiosvoboda.org/a/29015231.html.

7. Tolmach M. Digital technologies in education: opportunities and trends. Digital platform: information technology in the socio-cultural sphere. 2021. - № 4(2) - C. 159-170.

8. Rasulova N. Adaptive learning in the system of higher education. Scientific progress. 2021. – No. 3 (1). - P. 88-97.

9. Kiselyova K. How artificial intelligence can help education. Observatory 09/05/2018. URL:https://osvitoria.media/experience/yak-shtuchnyj-intelekt-mozhe-dopomogty-osviti/.

10. Zemba M. Artificial intelligence in education: world experience and ways of implementation in Ukraine. Universal education. 20.02.2020. URL: https://vseosvita.ua/library/statta-stucnij-intelekt-v-osviti-svitovij-dosvid-ta-slahi-realizacii-v-ukraini-211487.html.

11. How artificial intelligence works and prospects for its use. AI Conference Ukraine. URL:https://aiconference.com.ua/uk/news/printsipi-raboti-iskusstvennogo-intellekta-i-perspektiva-ego-ispolzovaniya-92238.

12. Concept of the development of artificial intelligence in Ukraine dated December 2, 2020 No. 1556. Update date: 12/29/2021. URL:https://zakon.rada.gov.ua/laws/show/1556-2020-%D1%80#Text.

13. Vyshnya G. Artificial intelligence and man: threats and opportunities. Radio Svoboda. 12.03.2021. URL:https://www.radiosvoboda.org/a/shtuchnyi-intelekt-zagrozy-i-mozhlyvisti/31145992.html.